
VICTORIAN ENTOMOLOGIST

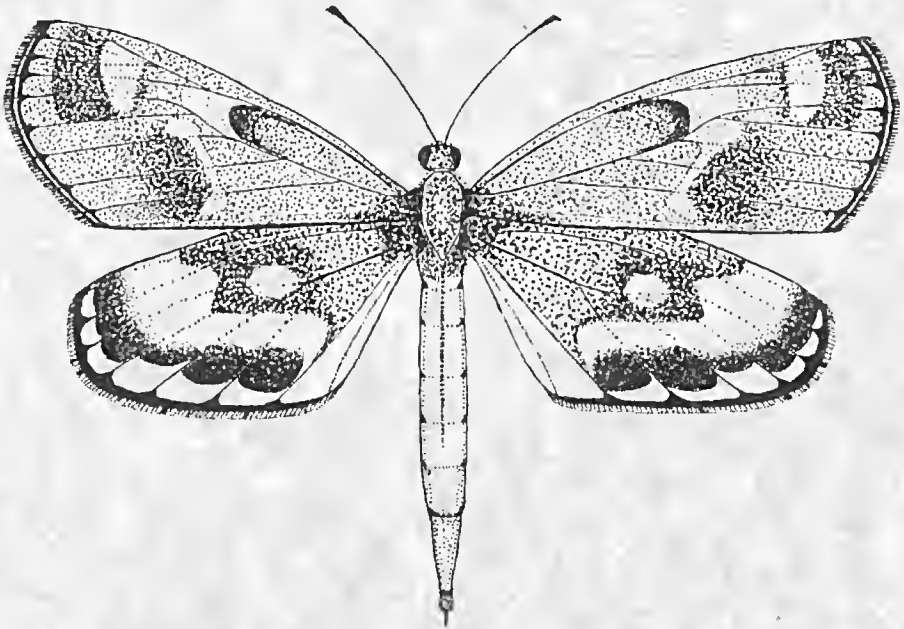


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News Bulletin of The Entomological Society of Victoria Inc.

THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)

MEMBERSHIP

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

OBJECTIVES

The aims of the Society are:

- (a) to stimulate the scientific study and discussion of all aspects of entomology,
- (b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
- (c) to compile a comprehensive list of all Victorian insect species,
- (d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

MEETINGS

The Society's meetings are held at the 'Discovery Centre', Lower Ground Floor, Museum Victoria, Carlton Gardens, Melway reference Map 43 K5 at 8 p.m. on the third Tuesday of even months, with the exception of the December meeting which is held on the second Tuesday. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

SUBSCRIPTIONS (2008)

Ordinary Member	\$30 (overseas members \$32)
Country Member	\$26 (Over 100 km from GPO Melbourne)
Student Member	\$18
Electronic (only)	\$20
Associate Member	\$ 7 (No News Bulletin)
Institution	\$35 (overseas Institutions \$40)

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

LIFE MEMBERS: P. Carwardine, Dr. R. Field, D. Holmes, Dr. T. New, Dr. K. Walker.

Cover design by Alan Hyman.

Cover illustration: The pale Sun Moth, *Synemon seleno* Klug, is an endangered species restricted to perennial grassland dominated by *Austrodanthonia* in Western Victoria. It is now extinct in SA, and was presumed extinct in Vic. until its rediscovery, in February 1991, by the late Frank Noelker and Fabian Douglas. The Victorian Populations are parthenogenetic with all specimens comprising females, a most unusual trait in the Castniidae. Illustration by Michael F. Braby.

Notes from the Entomological Society of Victoria
Excursion Ian Wark Forestry CSIRO lab 18th August 2009

Present: P. Marriott, M. Fiedel, M. Endersby, I. Endersby, P. Lillywhite
L. Levens, S. Curle, V. Curle, J. Tuttle, K. Harris, P. William, R. Best, J. Grubb,
J. Grubb, P. Carwardine

Apologies: D. Dobrosak, D. Stewart, G. Weekes, E. Cochrane, L. Rogan,

This year's excursion was a trip to the Ian Wark Forestry CSIRO laboratory in Clayton. Our kind host was Laurie Cookson.

Laurie met us and showed us around his department within the Division of Materials Science and Engineering. The group works on wood preservation, the biology and control of organisms and durability of wood products.

Throughout these notes, Laurie was able to show us real examples of the specimens, the damage caused and preservatives being trialled and tested. Some were alive (termites), many were preserved. I've tried to order these notes for ease of reading, though as you may appreciate, with the number of people we had on the excursion, the questions were coming to Laurie from all directions J

They have a fungal culture collection, which are agar cultures under sterile oil. The collection was started in 1935 but every 10 years or so needs to be rejuvenated.

They have over 2000 live fungal cultures, and work with 10-15 of the most active fungi.

For wood preservatives, they add test blocks to jars containing fungi and see what kind of mass loss there is over time. If the mass loss is less than 3% then the preservative is deemed as working. Throughout the visit, Laurie showed us how they were testing various chemicals and preservatives for all kinds of environments that wood would be subjected to. For example, one way to protect plywood is to add insecticide to the glue; and the various degrees of success.

Q. Is the fungus quarantined?

A. After use, everything is sterilised

Marine Borers. Marine borers damage piles in the sea, but they can even be found inland, e.g. in Bairnsdale, there has been lots of damage noticed in only 8 years. Red Gum is the timber commonly used for marine piling in Port Phillip Bay; should last for 50 years but can be destroyed in 8 years by marine borers at Bairnsdale.

Shipworm, is actually a mollusc.

Shipworm (e.g. *Teredo*) larvae the size of a pin head enter the wood; once they have entered they are unable to leave the wood and can grow to 30 cm or longer. They keep going with that piece of wood until it all disappears. They have the ability to strengthen their tunnels with a calcareous lining.

Another marine wood borer, *Martesia*, can be found in estuaries and oceans. They would naturally inhabit driftwood and timber in estuaries and oceans. A tropical wood borer, it is a filter feeder using the wood as a home and not for food. Whereas the Shipworm is boring for food as well as being a filter feeder.

Limnoria, this is a crustacean borer, a small isopod. The damage this causes is a fine pretty lacework pattern. They feed on the wood, and can produce their own cellulase enzyme to help degrade the substrate. Because they consume wood (unlike *Martesia* and *Sphaeroma*), they are easier to target with wood preservatives as these will also be consumed.

Sphaeroma, looks much like a pill bug. Doesn't feed on the wood, just lives in it. It is mainly active in the tidal zone from Batemans Bay to Cooktown.

One method to deal with wood borers is to put a plastic wrap around the piles.

Termites. They conduct both lab and field trials against termites; main field test sites are near Darwin.

Blue pine framing – a spray or dip treatment of pine to protect against termites. Quite effective even though it doesn't penetrate through all of the wood. Guaranteed for 25 years though will probably last longer, maybe up to 50 years.

They keep the two species of the most economically important termites in incubation rooms as well, *Coptotermes acinaciformis* and *Mastotermes darwiniensis*.

Mastotermes darwiniensis – is a large termite, and the most voracious (difficult to control) species – who have even attacked a dead buffalo horn and electrical cabling. It is restricted to tropical Australia, north of the Tropic of Capricorn. *Coptotermes acinaciformis* occurs throughout mainland Australia, and the same species produces mounds in Darwin but doesn't in Victoria. This maybe a response to temperature differences but this has yet to be investigated.

Workers termites are happy to work without the Queen but they decline after about 6 months.

Mastotermes is the most difficult species in the world to control; which is why AQIS tend to accept them for preservative trials. Their soldiers have Orange heads – which is the easiest way or identifying the different species – by the soldiers.

To collect healthy termites, place a piece of paper over the termites in a tray. If they are strong enough to cling to the paper, they are considered healthy enough to use.

One method of termite control developed at CSIRO is Granitgard, a non chemical barrier to termites – where the particles are too large to move for the termites, but too small to move through.

They also do work on Beetle Borers, especially Lyctine beetles also known as Powder Post Beetles.

A lot of Eucalypts have a thin sapwood band so beetle damage is often not structural – the lyctine beetle grubs are only feeding on the starch stored in the timber's sapwood. They breed up the beetles on a special biscuit in the lab.

A European species of Longicorn beetle, *Hylotrupes*, has been found established in pine plantations in Perth – understood to be the only species of longicorn (Cerambycidae) to attack seasoned timber.

Then we moved into the presentation room where we were able to view a sample of Laurie's own extensive personal collection of insects. Laurie gave us a presentation where we learnt some interesting facts followed by an interesting video of the work of the lab when they are out in the field.

From here we concluded our visit. We would like to thank Laurie for his generosity, for his time and patience in enabling us to see some his work, the work of the CSIRO in Clayton, bringing into work some of his own personal collection and for making this a thoroughly enjoyable excursion.

Previous Minutes:

Minutes of the Council Meeting [*Vic. Ent.* 39(4): 71] were accepted (P. Marriott, S.Curle).

Correspondence:

- Graham Moore from Kensington was duly elected as a member of the society.
- Three applications for new members received:
Cathy Car - Wagga NSW - taxonomy of insects and millipede studies
Deborah Arbuckle - Monbulk Vic - beetles
Martin Whatley - Student - Ararat Vic - Diploma in Conservation and Land Management
- The society has received the latest circular (August 2009 no. 140) from 'The Society for Insect Studies'. In summary, this latest circular contains articles on "More About Fruit Flies", a review of our societies publication "Collecting & Sampling Insects", "Moths, Bats & Websites, and are looking for expressions of interest for a trip to Sulawesi.
- The latest Australian Journal of Entomology, V48, part 3 2009 has been received. We have received the latest copy of *Myrmecia* 45 (3), August 2009.

Treasurers Report:

- The treasurer's report was unavailable for this meeting due to computer failure.

Editors Report:

No report presented.

General Business:

Praise was received for the images that we published as part of the previous general meeting minutes [*Vic.Ent.* 39(4): 68/69] – thank you Maik Fiedel for these images.

Editors Position

P. Marriott expressed concern that we have yet to find a candidate willing to take on the role of Editor for the society. This has to be recognised as a shared problem for the society and calls for anyone who may have the time or willingness to perform this vital duty for the society was requested again.

Publication of Victorian Lepidoptera

Moths of Victoria Part 2 has been completed and is now in publication.

Next Meetings:

If you are planning to attend any of these meetings; please refer to the website for any last minute amendments.

2009:			
Month	Date	Planned event	
September:	15 th	Council meeting	
October:	20 th	Members meeting	TBA
November:	17 th	Council meeting	
December:	8 th	Members meeting	Show n Tell Please note, December's meeting date is second Tuesday of December to try and avoid Christmas celebrations.
2010:			
Month	Date	Planned event	
January:		No meeting	
February:	16 th	Members Meeting	
March:	16 th	Council Meeting	
April:	20 th	AGM	
May:	18 th	Council meeting	
June:	15 th	Members meeting	
July:	20 th	Council meeting	
August:	17 th	Members meeting	
September:	21 st	Council meeting	
October:	19 th	Members excursion	
November:	16 th	Council meeting	
December:	14 th	Members meeting	Please note, December's meeting date is second Tuesday of December to try and avoid Christmas celebrations.

Meeting closed at 21:20

Minutes of the Council Meeting 15 September 2009

The meeting was opened by the President at 17:04

Present: P. Carwardine, D. Dobrosak, I. Endersby, M. Fiedel, P. Marriott

Apologies: S. Curle, V. Curle, P. Lillywhite, D. Stewart, K. Walker

Minutes: Minutes of the Council Meeting of 28 July 2009 [Vic. Ent. 39(4): 71-72] were confirmed. Endersby/Marriott.

Correspondence:

- (a) Copyright of *Vic. Ent.* It was Council's opinion that the Society does not hold copyright of author's works. Council will deliberate and amend the wording on inside back cover of the *Vic. Ent.* to reflect this and to require any approved reproduction to correctly cite *Vic. Ent.* as the first published source.
- (b) Harvey Lemelin emailed to advise he is conducting on-line interviews with individuals who have been involved in insect/spider conservation please. The survey can be found at http://humandimensionsofinsectconservation.wordpress.com/http://www.surveymonkey.com/s.aspx?sm=m9c7EXCaTowU6eo0JFcNwA_3d_3d.

- (c) The editor confirmed that the Zoological Record (U.K.) is receiving electronic copies of *Victorian Entomologist*.
- (d) Richard Zietek from Queensland is interested in establishing contacts in Victoria with people with interests in Beetle collecting. Please go to the Society's face book page to contact Richard.
- (e) Update of the Associations Incorporation Act - The Society must make some changes to comply with the Act. Ian Endersby will prepare a draft working document to table at the next Council meeting.
- (f) Up close and Spineless competition – closing date is 25 September. Ian Endersby to send information to the Society's mailing list.
- (g) Correspondence out –Reports sent to the Wettenthal Foundation will be published in this issue of *Victorian Entomologist*.

Treasurer's Report:

Account balances stand at General Account \$6,242; Awards Account \$5,464; Publications Account \$7,018. Five members are still in arrears and will now be deleted from the mailing list.

Editor's Report:

The editor has sufficient articles for the next issue. There was general agreement that there would be another colour issue this year and discussions were made about the costs of the colour printing and alternative, lower cost printers.

General Business:

Editor's Position: Council deliberated the options with a replacement editor and it was suggested that a co-editorship could be practical with the duties of preparation of the news bulletin and mail-out functions split between two people. The current editor prefers to continue with the mail-out function.

2009-2010 agenda: Discussions took place on the program for the remainder of the year and 2010.

Publications: The Society's publications have been well received and are selling well. Further work will take place to develop fold out charts and species checklists.

Web Site: Council unanimously endorsed Viv Curle's new web page and thanked her for her work on this task and taking on the webmaster position.

Society's archives: The balance of the Society's archives are being offered to members. The list of what is available will be published in the October issue of *Victorian Entomologist*.

Book Launch: There is the possibility of a sponsored book launch for the Moths of Victoria books. Details will be published when available should this proceed.

Council meeting time: Some Councillor's are having difficulties with the start time of 5pm. The start time may change to a later time e.g. 6pm by mutual agreement of the Council members.

Meeting closed 6.25pm

Bee Hawk Moth (Lepidoptera: Sphingidae: *Cephanodes kingii* Macleay) A Victorian record

Peter Marriott – 8 Adam St. Bentleigh Vic (marriott@netlink.com.au)

Jim Tuttle has drawn attention to the presence of a Bee Hawk Moth in the Melbourne Museum collection from Maryborough in central Victoria (figured below). This is an additional record of this moth for the Victorian Checklist published by the author (2008).

With its 'see-through' wings and day-flying habit it is an interesting moth indeed. There are records for NSW extending almost to the southern border so it is possible that it is more widely distributed in the northern part of Victoria.

Common (1990) lists larval food plants as mainly in the family Rubiaceae including several *Canthium* species and the introduced *Gardenia*. Common also indicates that the wings are covered with scales when the adult first emerges but most are soon lost.



An update for Moths of Victoria Part 1 will be developed and sent to those who have registered to have updates sent electronically.

References:

Common, I.F.B. (1990). *Moths of Australia* (Melbourne University Press)

Marriott, P.J. (2008). *Moths of Victoria Part 1* (Entomological Society of Victoria)

Disposal of Society's Archives

Over many years the Society has accumulated a large number of boxes of journals, both the *Victorian Entomologist* back issues, and other publications received in exchange. They have not been accessed for a long time and so the Council has agreed to dispose of them. The Museum of Victoria will subsume some of them into its collection and the remainder are being offered to members of the Society.

There are no complete runs but many parts are available in the year range shown in the table. Members can have them for the cost of postage; please send your requests to treasurer@entsocvic.org.au

Anything remaining at the end of 2009 will be recycled responsibly.

Journal	Year	
Antenna	1977	1980
Aust Entomol Soc News Bulletin	1966	1981
Australian Natural History	1962	1973
Australian Zoologist	1966	1975
Bulletin Ecological Soc Australia	1998	2002
General and Applied Entomol	1979	1989
J. ent Soc Aust (NSW)	1965	1976
J. Entomol Soc Queensland	1962	1964
Journal Aust Entomol Soc	1967	1994
Journal Lepidopterists' Soc	1959	1993
Myrmecia	1989	1999
News Bull Ent Soc Queensland	1972	2008
News of the Lepidopterists' Society	1974	1993
Systematic Entomology	1976	1977
Teen Internat Entomol Group Newsletter	1970	1973
The Lepidopterists' News	1955	1958
The Weta	1990	
Trans Roy ent Soc London	1963	1975
Victorian Entomologist	1979	2005
Victorian Naturalist	1929	1981
Wildlife in Australia	1968	1976

A Range Extension of *Acatapaustus metallopa* (Lepidoptera: Nolidae)

Ken Harris

26 Haverbrack Crescent, Churchill 3842 – kennedyh@iinet.com.au

Peter Marriott gives a fairly restricted range for the Nolid Moth *Acatapaustus metallopa*, mainly around Eastern Melbourne.

On 17th November 2008, I found this species by daylight while exploring the flora of a property in Darlimurla, near Mirboo North. I have photographs, but it is a very worn specimen.

Eight days later, on 25th November 2008, I found it again attracted by lights to my house in Churchill.

I was able to identify the moths by reference to the internet using Don Herbison-Evans site, subsequently confirming the identification by reference to the Victorian Museum collection.



The Darlimurla record extends the distribution well east of that shown and the Churchill record takes it a further 30 km east.

The illustration is the specimen I found in Churchill.

References

Marriott, Peter 2009. Moths of Victoria. Part 2 Tiger Moths and Allies. Noctuidae (A)

Don Herbison-Evans and Stella Crossley, 2009. Caterpillars: especially Australian ones.
<http://linus.socs.uts.edu.au/~don/larvae/larvae.html>

Overview of the Butterfly Database: Part 2 – Current Composition, Imbalances and Factors of Influence

Kelvyn L Dunn

Email: kelvyn_dunn@yahoo.com

Introduction: Part 1 of this series (Dunn 2009) introduced the project (1), overviewed the database history (2), and unravelled its inception (3). It discussed trammels of information concealment, and drew upon some limitations exposed in Quick's forerunner project as valuable lessons learnt. Quick's promotional efforts within a wary entomological fraternity during the 1970s effectively served as an icebreaker for the Dunn and Dunn butterfly project, easing its aims and directives for the following decade. This second report (Part 2) focuses on distortions in the current database and historic factors of influence (4). Many distortions link to the sampling methods of amateurs – the main contributors of butterfly records – whose survey has largely involved opportunistic netting of adults along carriageways and walking trails leaving vast areas of habitat unexamined. Their methodology was seasonally motivated, convenience-based as a pastime, and often involved revisiting traditional sites of higher yield in eastern Australia. An analysis of the database coverage affirms that this process, at odds with a systematic approach for continental coverage, has failed to provide complete spatial and temporal butterfly information (5). Indeed, Dingle *et al.* (2000: 205) wrote: *"much of the interior of Australia is so little collected that the total number of butterfly individuals barely exceeds the small number of species for which there are records"*. Nonetheless, the collector-process has achieved a comprehensive knowledge of regional areas close to major cities and areas of residency. Accumulating baseline data show that the northern half of the continent has been under-surveyed, and that a western paucity of records is most damaging in association with a lower faunal richness. Today, conservation and cultural barriers increasingly deter extensive amateur exploration in many remote areas, but action to develop flexibility with collector fact-gathering requirements may help retain this valuable information flow to expand upon current knowledge (6). It would be a shame 'to kill the goose that laid the golden egg'!

Definitions: My reference to 'amateur' workers and study is in the same positive context of Moulds (1999), without nuance of lessened workmanship or scholarship, but encompasses all enthusiasts (collectors and researchers) whose employment history is mostly outside of entomology. 'Sites' and 'records' are as defined previously (Dunn & Dunn 2006: see *Note 17(iv)*, p.832 & *Note 14*, p.826, respectively) and are in accordance with the context and purposes of the database project. These definitions may differ from those established for others' compilations of inventory data.

4. Regional distortions in the current database and some historic factors of influence

The atlas set of 1991 promoted awareness of the need to explore and publicly collate butterfly records to offset exposed regional imbalances, as evinced by subsequent workers voicing their linked persuasion. It motivated Puccetti (1991), who had focussed his opportunistic and remote sampling near the Gulf of Carpentaria, to promptly publish his records. His compilation included six species from sites hundreds of kilometres beyond their documented ranges at that time. Kitching and Dunn (1999: 61) affirmed that, *"Puccetti's achievements increased the known Carpentaria fauna by 64%"*. Soon after, Williams *et al.* (1996) initiated surveys into the remote, central desert region and other semi-arid areas of outback Western Australia. His exploratory team emphasised too how the *"Distribution maps in Dunn and Dunn (1991) show graphically how little published information is currently available"* (p.29), indicating a measure of the sets' influence on areas to target. Yet these isolated examples are just that; Victorian Entomologist 39(5) October 2009

arguably more the exception than the rule within the enthusiast culture in the 1990s, so repeated encouragement (Sands & New 2002, New & Sands 2004) to continue exploration farther afield was not amiss. The advancing trend has not abated (see, *inter alia*, Franklin *et al.* 2005, Franklin 2007, and Pierce 2008), and no doubt others will become enthused to investigate poorly surveyed areas to reduce gaps in distributions.

In spatial terms, exploration versus habituation may seem diametrically opposed, but in augmenting temporal charts, the latter does have a positive side. Regular sampling over seasons and decades at the same sites fortifies knowledge of regional flight periods and longitudinal continuity within habitats, leading to data saturation as to the species present. Yet habituation, now redressed with a positive nuance as 'purposive seasonal sampling', remains constrained by environmental factors and collector interests, creative of sampling incompleteness across months of likely flight activity for the component faunas. For example, traversing some large tracts of northern Australia and the outback is arduous by road and at times seasonally inadvisable off major highways. Monsoons in the north herald lengthy deluges that regularly result in flooded causeways, road-wash-outs or impassable quagmires, restricting usage of conventional vehicles. In the south, unpredictable spring sunshine and wind-chill limit flight activity, and lengthy road closure due to high fire danger in summer is similarly adversative. Extended droughts in the inland too, with a corresponding reduction of flowers impoverishing attractions of adults, can thwart even the most enthusiastic on a field trip of short duration. Additively, a collector-focus on specimen quality (Asher *et al.* 2001) hones attention to species' seasonal emergence and limits the incentive to survey off-season when adults are sparse or in poor condition. Ironically, specimens reared indoors or in incubators, being ideal for display and promoted for conservation (Sands & New 2002), may poorly reflect local seasonal appearances (Atkins *et al.* 1991, Dunn & Dunn 1991, Braby & Douglas 2004, Williams & Miller 2008). Their overrepresentation among ephemeral species in collections distorts temporal data, especially where these aspects are undocumented on the specimen labels (Dunn & Dunn 2006).

Collector interests in the field have often come into historical play; whether these are positively termed 'group specialisation' or merely as 'focussed exclusion'. Concentration on the unusual, it seems, overrides motivation to list exact sites or dates of encounters for mere entomic humdrum – enforced spacing and financial constraints of journal pages aside. The 1980s saw a paradigm shift from expert-opinion to empiricism underwriting knowledge presentations, with 'evidence-based' reporting and 'best practice' policies for Australian entomology – and other disciplines too – ideally to improve general workmanship from the global directive. Before this shift away from collector parochialism, some field reports simply glossed over abundant groups, labelling them as 'common' and 'widespread' – Le Souëf (1971) being just one historic example that comes to mind. Others, (e.g. McQuillan and Fisher 1985) when providing expert opinions (rather than supportive evidence) sometimes overgeneralised their field observations of widespread or migratory species, therein embedding assumptions of continuity at the fine scale across broad regions, valid or otherwise. Moreover, some butterfly collectors' passions have been so hinged on the 'take' – namely the possession of the exquisite over the mundane – that they often neglected to record those widespread species seen at sites visited (Dunn *et al.* 1994, Lambkin 2009). Although this collector bias still lingers on in some works, attitudes have changed over the last few decades. ... Eastwood *et al.* (2008) recently emphasised the need to publish baseline data in order to underpin broader research objectives, and Franklin *et al.* (2005) had similarly encouraged the placing of inventory data on butterflies on public record. Focus on butterflies as 'indicator species' of habitat change (New 1991), although no longer recommended in isolation of other groups for conservation studies (Kremen *et al.* 2003) certainly helped promote the value of databases.

As a *post hoc* compilation of inventory data from varied sources, the composition of the database has obviously been swayed by serendipity and convenience sampling by the many dedicated amateurs responsible for most of the records (see Dunn 2009). Their non-random approach has also enhanced and simultaneously limited the project's major historic data pool – the 51 percent of all known Australian material in museum collections originally sampled for the 1991 atlas set (Dunn & Dunn 2006). The stakes discussed – namely collector partiality and incomplete inventory data – explain, at least in part, some distortions in the maps and charts in the atlas set, and still strongly sway the balance of current holdings. These limitations remain beyond the control of the database compilers, as passive recipients of collectors' voluntary contributions and the contemporary holdings in museums made available.

5. Current database composition

Dunn (2008) recently summarised the database holdings; Table 1 outlines these in terms of major data categories as reported in that briefing. It shows the proportions of specimens housed in institutions, from literature sources, and those privately held. Most databases linked to government repositories serve primarily as catalogues of holdings rather than having a purposive design to measure distributions of species. This influences their representativeness and suitability for other uses, often requiring enrichment to exclude for imbalances. My inclusion of literature and private contributions as database enrichment, comprising thousands of observations, provides unique material presently unavailable in museums (Dunn 2008). An increasing proportion of observations over time has begun to offset skews linked to collection representativeness, providing a now moderate inclusiveness. Nonetheless, institution holdings still comprise a large portion at 39 percent (Table 1).

Table 1. Outline of database: categorical holdings (tallies and percentages rounded to the nearest 100). Source: Dunn (2008).

Data Categories	Data records (rounded to nearest 100)	Rounded percentage (%)
Government specimens	50 500	39
Literature-sourced records	46 000	35
Total private contributions	34 000	26
Total records	130 500	100

The database coverage varies extensively across political regions of states and territories, and this broadly links in to regional faunal richness within jurisdictions – Queensland having the highest percentage of species (83%) and Tasmania, the lowest (9%) (Table 2). The collector 'catch', the mean number of 'records per species', is highest in Victoria (191.1). Queensland, New South Wales and Tasmania too, having moderately high 'catch' scores, but the Australian Capital Territory (ACT) Victorian Entomologist 39(5) October 2009

scores lowest (19.3) (Table 2). 'Sampling intensity' defined in terms of 'records per thousand square kilometres' provides another objective comparison. Based on the original (1991) database, the ACT was the most intensely sampled political region (Dunn & Dunn 2006). This finding is still true of the current holdings, as their relative proportions across jurisdictions remain similar (Table 2 *cf.* Dunn & Dunn 2006: 822). In contrast, Western Australia has the lowest intensity of survey as a function of land area (Dunn & Dunn 2006). Nonetheless, it shows moderate representation in terms of 'catch' per region (Table 2), especially when compared with the 'catch' for the Northern Territory, the latter having a much smaller land area but similar number of species (Table 2).

Table 2. Outline of database (2008): jurisdictional holdings. 'Catch' – a measure of sampling intensity – comprises the average number of records per species, for each jurisdiction (irrespective of land area or spatiality of sites within regions). NB: Total species (modified since Dunn 2008): Adjustment made for changes in taxonomy of species to 2008 inclusive, *viz.* reduction of one for Qld: synonymy of taxon *gilberti* Waterhouse (Lycaenidae). Total species unchanged due to resurrection of taxon *waterhousei* Bethune-Baker (Lycaenidae).

Geo-political Regions	Data records (rounded to nearest 100) (A)	Data records: Rounded percentage (%)	Total species (B)	Total species: Rounded percentage (%)	Catch: Mean records per species (A/B)
Queensland (Qld)	60 600	46	360	83	168.3
New South Wales (NSW)	26 000	20	222	51	117.1
Aust. Capital Territory (ACT)	1 700	1	88	20	19.3
Victoria (Vic.)	23 700	18	124	29	191.1
Tasmania (Tas.)	4 100	3	39	9	105.1
South Australia (SA)	3 400	3	76	18	44.7
Northern Territory (NT)	4 900	4	138	41	35.5
Western Australia (WA)	6 100	5	130	30	46.9
Australia	130 500	100	434	100	300.7

(a) Numbers of records:

Division of Australia into eastern/western and northern/southern sectors provides broadly comparable land areas for examination of gross continental distortions in data accumulated. The most obvious imbalances exist in the 'number of records' (Table 3), with a significant western paucity – only 9 percent of 'records' have originated from that region. The remarkably sharp gradients in species richness towards the east (Kitching & Dunn 1999) are undoubtedly contributory. Here steep attenuations in moisture gradients and the enriched floristic diversity support that butterfly richness (Hill & Kitching 1983, Kitching & Dunn 1999). Astonishingly indeed, eastern Australia contains 92 percent of all the butterfly species known from political Australia (Table 3) – a major natural imbalance – hence more records would accumulate from the east on probability alone. The mean catch compensates for the richness component, moderating the difference in the massive east-west skew to about 5:1 (Table 3). Accepting this ratio at face value suggests a minimal five-fold greater sampling intensity for eastern Australia.

A second imbalance exposed is the moderate northern paucity relative to the south. Only 36 percent of records come from northern Australia (Table 3) despite this region having more species (81% of the fauna) (Table 3). Higher species richness (Kitching & Dunn 1999) would predict the opposite if the holdings had accumulated randomly. Leanness in the 'numbers of records' for species in northern Australia concerned some examiners of the atlas set, especially those who resided in that region, leading to suggestions of regional low representativeness within the database (see Dunn & Dunn 2006). The mean catch adjustment here only marginally boosts the ratio, from 1:2 based on mean 'numbers of records' per region, to about 2:5 for the north-south skew (Table 3). It suggests a two and a half-fold sampling intensity for southern Australia relative to the north, albeit considerably less extreme than the east-west disparity.

(Continued Page 94)

Table 3. Outline of database (2008): cross-sectional holdings. NB: Total species (modified since Dunn 2008): Adjustments made for changes in taxonomy of species to 2008 inclusive, *viz.* reduction of one for each of northern and eastern Australia: synonymy of taxon *gilberti* Waterhouse (Lycaenidae). Addition of one for southern Australia: resurrection of taxon *waterhousei* Bethune-Baker (Lycaenidae).

Geo-political Regions	Data records (rounded to nearest 100) (A)	Data records: Rounded percentage (%)	Total species (B)	Total species: Rounded percentage (%)	Catch: Mean records per species (A/B)	Catch ratio
Eastern Australia Longitude E>135°00'	119 100	91*	400	92	297.7	5
Western Australia Longitude E<134°59'	11 400	9	180	41	63.3	1
Northern Australia Latitude S<24°59'	47 000	36	351	81	133.9	2
Southern Australia latitude S>25°00'	83 500	64	276	64	302.5	5
Political Australia	130 500	100	434	100	300.7	—

* Dunn (2008) estimated that over “89 percent” of records are from eastern Australia. This alternate figure was calculated by summing records for the eastern states and territories (Dunn & Dunn 2006, Table 437) – with SA, NT and WA comprising the ‘western’ remainder. It closely approximates the figure of 91% derived from a longitudinal split that more evenly balances the land areas.

Convenience collecting linked to southern residency of most collectors reasonably explains the anomalous northern paucity. Much of the populace currently lives in eight capital cities of Australia. The northern and western regions as defined (Table 3), include only one and two, respectively – namely, Darwin for the north, and both Darwin and Perth for the west. Indeed, historic sampling has

mostly been close to collectors' residences (Edwards 2006), with the hinterlands of the major southern cities having been particularly favoured (Kitching & Dunn 1999). Beyond the densely settled regions of the east and south, survey has been sparse (Dunn & Dunn 2006). Concurring with this, Franklin *et al.* (2005: 6) impressed that there appears to be "*a steep decline in the intensity of previous surveys away from the main settled areas ... of north-western Australia.*" These biasing factors of close proximity and convenience have overridden the effects of the north-south species richness isoclines (Kitching & Dunn 1999), and compounded the western paucity of records, already intensified by its regionally species paucity. One hundred and eighty (180) species for the western section is only 41 percent of the total for political Australia (434 spp.) (Table 3). As well as convenience sampling by collectors, other underlying factors, such as the extensive overlap of widespread species across regions, provide a layer of difficulty or limitation when taking these 'sampling intensity' figures as unquestioned.

(b) Numbers of sites:

The lack of exploration by butterfly observers (Sands & New 2002) has influenced the regional imbalances evident in the 'numbers of sites' (rather than records) and their vast spatiality away from the coastal plains (Dunn & Dunn 2006). Habituation of sampling also underwrites this because when collectors revisit sites they do so at the expense of looking elsewhere (Sands & New 2002). Moreover, in Australia, exploratory sampling of the vast inland wildernesses can be less rewarding (New & Sands 2004) largely due to low species richness (Kitching & Dunn 1999). Consequently, there has been minimal butterfly exploration in many remote inland deserts and semi-arid regions of Australia to date (Dunn & Dunn 1991, Williams *et al.* 1996, Franklin 2007, Ginn *et al.* 2007), limiting available data to widely scattered sites. By corollary, the dramatic gradients in species-richness in the east (Kitching & Dunn 1999) have skewed survey incentives nationwide, as collectors tend to evaluate take for the cabinet against their personal costs and recreational time availability (Sands & New 2002). In particular, the relatively over-worked 'wet tropics' of Queensland entices the novice and habituated collector too, due to local high diversity and presence of many beautiful species, with personal stakes in filling cabinets motivating repeat visits for better quality specimens. Sites renowned for their higher yield of precious species have become traditional haunts over the decades, famously known and visited by all. Think Grafton! Think Leyburn! Even Expedition Range! And what enthusiast would miss the Claudie River on Cape York Peninsula for a taste of New Guinea? Remarkably, about 3 percent of records have come from one locality on the Atherton Tablelands – namely Kuranda – where at least 211 species (49%) reside! (Over its century or so of fame, this tiny village has probably had more resident entomologists than any other country town in Australia!) Areas of generic endemism and recent speciation similarly add alluring mystique, especially for the southwest of Western Australia. These ancestral assemblages repeatedly attract collectors of an advanced calibre seeking cryptic or unrecognised species to name. Overall, collector-partiality has acted on the representation of the inventory data against a random spread of sites and months, and has promoted a plethora of records from choice localities.

Given the focus on traditional sites (New & Sands 2004) or regions of unique assemblages (Sands & New 2002), one would expect that the number of new sites would not increase proportionally against the baseline holdings of 1991. However, the 'number of sites' has risen from 7,346 in the later stages of the atlas set (Dunn & Dunn 1991) to over 12,000 to the time of last report (Dunn 2008) – this is a significant increase of 63 percent. In contrast, over the same period, the 'number of records' increased by only 48 percent (Dunn 2008), lending to a 15 percent increase in the 'number of sites' over and above the increase in the 'number of records'. In terms of 'total records per total sites' (r/s) there has been a decline from an average of 12.0 r/s calculated for the 1991 database to 10.9 r/s for the current data set (2008). Thus, the average records per sites for 1991 has dropped by about 10 percent due to a small but significant increase in the denominator (total sites) over the subsequent years of collation.

This indicates a measure of advancement in knowledge of distribution (assuming earlier limitations still apply to ongoing data accumulations), and suggests a change in collectors' interest towards surveying new areas.

It is likely though, that most of the growth in sites has been towards coastal regions and other already densely surveyed sectors, yet many new sites continue to accumulate along major transport routes through inland areas. Survey along roadsides is a routine methodology amongst the collector fraternity (see, *inter alia*, Valentine & Johnson 2000 who specify it as theirs), but it remains limited as it leaves potential habitats away from roads unexamined (Hart & Powell 1997). Some criticised the project's reliance on this methodology but none has suggested a feasible alternative for spatial survey, albeit that Ginn *et al.* (2007) proposed malaise trapping as one means to enhance temporal data at fixed sites. Ginn *et al.* (2007: 73) concluded that, "*The end result is that a number of spatially remote sites can be sampled at the same time with reduced labour and other logistic costs.*" Clearly, it is presently impracticable to survey across the whole continent using either a systematic or a random basis for site selections. The limitations of convenience sampling will likely remain an unfortunate complicity of conventional vehicular survey in outback Australia for a long time to come. The methodology of accessibility becomes visually apparent in the outputs, which, years ago, had led Quick (1976: 39) to refer to these, colloquially, as 'species road maps.' Achievements similar to the mapping of butterflies in the United Kingdom (Asher *et al.* 2001) is far from reality for wildernesses in Australia, or even Victoria for that matter – the small number of local workers aside (Braby *et al.* 1997). Australia cannot boast survey intensity on a square-kilometre basis over much of the continent, and adding facetiousness here, systematic sampling using helicopter-access – optimal for the inaccessible Australian deserts – is well outside funding constraints of the project. Hence, any reasonable examiner would not raise roadside-sampling design as objectionable at the continental scale, although surprisingly, one or more verbally has!

6. Increasing political and conservation encumbrances to data-gathering

"Some will doubtless look upon any encouragement to collect butterflies as politically incorrect. Even if that social barrier can be surmounted, there is the ever restrictive process of acquiring permits" (Scoble 2001: 378).

In recent decades, amateurs have reported increasing difficulties obtaining insect collecting permits for high-level conservation reserves (Greenslade 1999). The well intended, but stringent requirements serve to protect the fauna, but also help maintain data paucity by inherent prohibition of take and imposition of penalties for doing so (Sands & New 2002). Some who are dependent on netting may avoid entering reservations, but of late, many experts have relinquished their trapping devices, trialing photography or field glasses to verify identifications without handling. This seems commendable on face value, but in one or more jurisdictions even observation-based records might be deemed 'commercial purpose' or 'scientific purpose', if data are intended for an outcome such as a publication (Braby 2007). Avoidance of any 'interference' – a universal requirement – can act against a quality photograph of an insect and, perhaps too, its usefulness for later identification. With increasing reservation, there now seem many obstacles to ongoing and trustworthy data contributions. One insect enthusiast who offered observations from Kakadu National Park, a species-rich region of the Northern Territory, and one from which I had hoped many new temporal records might be forthcoming, disappointedly explained his small contribution to the database. "*My NT sojourn was severely restricted by having no collecting permit. I did try but was knocked back... Saw heaps of butterflies but was unable to put names confidently without the specimen in hand – better on moths!*" These circumstances add to a disheartening collector-experience for many (Greenslade 1999). The restrictions on take or an obligatory requirement for its deposition in institutions can remove some

personal incentives, which often act as primary motivators for amateur fieldwork given that it is costly on recreational time and personal funding.

My own experience with applications has been largely positive though, undoubtedly supported through ongoing membership with professional societies, period employment with research organisations, and my directorship of the database project. As a result, since 1979 I have periodically held permits in eastern states of Australia, including some during the 1990s of regional or complete coverage, generous 12-monthly open-access, and with option for annual renewal. Today, park managerial bodies may feel under pressure due to greater public awareness of conservation. This might create a reluctance to approve amateur work, and perhaps limit harassment of rangers from a barrage of distracting mobile-phone complaints. A recent application of mine to survey a number of remote high-level reserves in Western Australia – specifically for the butterfly database project – received support from two well-known professional referees, and gave reference to my publications on the project for reinforcement. Importantly, it stated my intention to place voucher material in one or more interstate museums. Its decline – without a written explanation – obviously raises questions as to what constitutes a worthy amateur project for approval to take. In addition to their protective role reinforced here, I believe that conservation bodies have a ‘duty of care’ in their custodianship of invertebrate fauna to authorise ongoing amateur discoveries by serendipity and opportunistic netting – all facts and collector reputations considered. Denial of survey for a legitimate study – which I accord my own – breaches the third ethical recommendation of Greenslade (1999) advocating support for amateur research. It is just a guideline, not policy, but given this recent experience and my communications with others, it seems that the call by Sands and New (2002: 26) for conservation gatekeepers to “foster a cooperative approach” needs reiterating!

It is vital to optimise rather than thwart amateur discovery. Informed management of reserves must include entomological exploration and acceptance of the help of volunteering experts who are not (or no longer, as in my case) affiliated by employment in the entomological profession. Sands and New (2002: 28) called for the “*Active encouragement of surveys of protected areas, or other key localities for which inventory data on butterflies will enhance conservation perspective.*” Encouragement to survey, whether structured or ad hoc, enables a baseline of reliable records to be compiled by skilled amateurs, and whose lay efforts to date have fundamentally supported analyses of butterfly biogeography (Kitching & Dunn 1999). Following Queensland’s example, a supportive process for members of entomological societies to administer survey access (Braby 2007) could encourage more amateur exploration of large and poorly known reserves, particularly in the western half of Australia. Perhaps periodic ‘open-seasons’ of loosened restrictions for invertebrate sampling would also help balance the regional knowledge deficits quantitatively exposed (Table 3). Such cooperative endeavour would enable more new localities to be discovered and declared without fears of reprisal (Sands & New 2002). Importantly, it could direct survey intensity away from traditional haunts closer to human habitation where localised species are under increasing pressure from habitat fragmentation (Sands & New 2002).

The paucity of entomological data available from much of northern and western Australia is indisputable (Tables 2 & 3). For some native lands and conservation reserves, very few records exist, and those that do are of limited seasonal or spatial extent, adding to a fragmentary knowledge to date (Dunn & Dunn 1991, Braby 2000). Moreover, an independent investigation into data coverage has corroborated this, with a specific claim that the “*representation of butterflies in most national parks is simply unknown other than by serendipitous accumulation of records*” (Sands & New 2002: 26). Far from the state of scientific omniscience that perhaps some ‘armchair’ conservationists think exists, the absence of adequate baseline data, even for butterflies – the best known among invertebrate groups –

sounds forth. Franklin *et al.* (2005: 6) assessed that "[V]ery much remains to be learned about butterfly distributions in the larger portion of north-western Australia." Affirming survey action too, Ginn *et al.* (2007: 74) directed that "There is much more work needed in remote parts of Australia before a good understanding of the broad-scale distribution and seasonality of Australian butterflies is obtained." Although hypothesis-driven research is fundamental to species knowledge and park management, open-ended data gathering by amateurs is still contributory (New & Sands 2004).

Most professional entomologists concur with amateur decision-making as to when the need for vouchers from outlier localities and some species groups is required. New and Sands (2004: 260) reminded that "Most knowledge of biology and distribution of butterflies in Australia resides outside the scientific establishment." Almost two decades ago, New (1991) affirmed, in a handbook promoting butterfly conservation, that responsible collecting is appropriate at times, and Sands (1999) emphasised this further by reinforcing the difficulty of identifying many species in the field. Supportively, Beale (1997) experientially discovered, as a part of his conservation-based survey studies in Queensland, that many Australian lycaenid butterflies are impossible to identify in flight. After conducting observation-based studies in National Parks in northern Australia, Franklin *et al.* (2005) argued too that a requirement of handling or taking of vouchers is a reasonable call for the Hesperidae. The evidence is clear. Surveys augmented by selected vouchers for later expert examination, dissection, or genetic sequencing as needed, provide an evidence-basis for decision making, an arena into which to move forward in absence of unfounded fears of over-collection (Sands & New 2002). Policy writers and law enforcers must appreciate that the conservation approach and population dynamics of insects differ from vertebrates (Sands 2005), and that habitat preservation is what is essential for invertebrates' survival (New & Sands 2004). In fact, Braby (2000) has expertly judged that the removal of individual insects from large reserves will not have any impact!

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FINAL REPORT to
The Norman Wettenhall Foundation
With respect to grant for financial support

Grant Holder:	Entomological Society of Victoria
Author of Report:	Peter Marriott, leader of project, author
Project Name:	Moths of Victoria – An Illustrated Checklist
Reference number:	20077592
Date of Payment:	15/09/2008
Date of Report:	August 2009

PROJECT

Project Objectives

The application was to provide the financial resources for part of a project to address the community's access to accurate and comprehensive information about Victoria's Lepidoptera. The overall project objectives are:

1. To produce a checklist of Victorian Lepidoptera.
2. To develop an 'on-line' facility for dissemination and identification of Victorian Lepidoptera.
3. To publish, in hard copy, identification guides that are easy to understand, inexpensive and practical in their application.
4. To provide for a rigorous process to accurately expand the checklist and further the understanding of Victoria's Lepidopteran fauna.

The initial grant request was for money to finance the first two hard copy guides and use the income stream generated to finance future guides.

Progress and outcomes

1. Checklist

As each booklet was developed checklists were finalised. The National Insect collection (ANIC) was used to supplement the material garnered through the Melbourne Museum and personal records. From the time of the application to publication current lists based on the Melbourne collection have been supplemented with up to 25% additional records. This was greater than expected.

The process is ongoing.

2. On-line Facility

The Society has shifted in its approach to this in response to the rapid development of other on-line resources. The Society ran a workshop/Forum on web publishing in 2008 where the issues were discussed and it has been decided that we should work in with existing systems rather than seeking to develop a site which would be expensive in size and effort.

The publication of checklists for moths and other insects is being implemented through our regular publication. Our website is presently being revamped and these lists will be posted but will not be supported by images at this time. Images have been made available however to various people and will be expanded over time. For example the project images from the booklet will be used by Melbourne Museum in its on-line data project; The on-line data base of moths and caterpillars developed by Don Herbisson-Evans will progressively use images and information from the project to supplement the Australian material. In this way the species will be kept up to date on the Society website with visual figures available on other web sites and in the Society's publications.

3. Guide books

The first two of these have been now published - MoV1 in November, 2008 and MoV2 in July, 2009. There are currently three more being developed for release over the next 18 months with plans for a further three already in the planning stages. MoV1 has 83 species (including 10 that have not been formally been described) and MoV2 has 175 species (28 not formally described). Booklet sizes are 32 and 36 pages respectively and 175 pages and 300+ additional pages are on the respective disks. As the project proceeds we are able to get more moths in natural resting positions and are now able to figure between 70% and 80% of the species covered in this way, as well as having every species figured as set specimens.

As the project has progressed we have altered the order of books to suit authors and available material. This will probably mean we can bring books out more quickly by having more than one team operating at any given time. The concept, layout and basic material will all be treated as in the first books.

4. Processes for future development

Formal procedures for checklist preparation have been developed and published through our regular publication and some checklists have already been published (e.g. the order Neuroptera and the moth family Hepialidae). There are others in preparation. Society members and others interested in Entomology are encouraged to (and do) feed information to the society. A process for updating the published information is in place. Update pages for the book are now distributed free of charge to those who register for the service. This is outlined on a page on the disk accompanying Book 2).

Benefits and evaluation

This is a long term project and it is anticipated that the benefits will be seen over a long period. However we have already have had many good pieces of feedback, which have been reported in an earlier interim report. We have had an unsolicited \$200.00 donation from a Queensland buyer who wished to further support the project because of his perception of the benefits to this area of study. Unexpectedly our membership has increased and more people attend our regular meetings. A number of book retailers and organizations have approached us to carry the book and they report a high level of interest. Additional people have offered support and joined the project in key roles including as authors.

Reviews have been, unsolicited and very positive.

The Lepidopterist community meet every two years in Canberra and are extremely enthusiastic about the publications. Already the first book is being cited and is rapidly becoming a standard reference. That is not surprising as there is no other comprehensive publication for Victoria. What is surprising is the number of readers from other states who are using the first book as a primary

reference. We have purchasers from every state as well as the US and Europe who include keen naturalists, professional entomologists, ecological businesses, institutions and photographers.

The sales of the booklets indicate a level of interest that has also been surprising. We anticipate that all books in the first run of 1,000 units for each book will be taken up. Book 1, as at 31 August, has reached 555 units and book 2 (in five weeks) has passed 270.

The interest in the updates is continually growing.

Further species are being added to our list from others not necessarily involved with the project. There are two additional Hawk Moths and a new species of Snout Moth that have been reported to us in the last two months. Some range extensions have also been reported.

The concept of an income stream to finance future booklets in the series is satisfactory and the next two books can be confidently managed. This will need to be monitored however.

The upsurge of interest in entomology in general and moths in particular is most gratifying. This cannot be entirely due to these two publications as the advent of digital photography and the ability to record very small details has changed the way many people view the natural world. However, there has been a need to place things, to name things, to understand the relationships. This development is not unlike that for plants and birds in earlier times. This grant has enabled the serious observation and study of moths to reach out to a similar community.

Our appreciation and gratitude to the Wettenhall Foundation should not be underestimated.

Peter Marriott

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The Australian Entomological Society publishes the *Australian Journal of Entomology* quarterly. The Entomological Society of Victoria is an affiliated society and will, in future, publish the contents of the journal for the wider interest of its members.

OVERVIEW

Richard C Russell Mosquito-borne disease and climate change in Australia: time for a reality check

SYSTEMATICS

Rosalyn Gloag, Scott R Shaw & Chris Burwell. A new species of *Syntretus* Foerster (Hymenoptera: Braconidae: Euphorinae), a parasitoid of the stingless bee *Trigona carbonaria* Smith (Hymenoptera: Apidae: Meliponinae)

Karen L Bell & T Keith Philips. New species of the myrmecophile *Polyplocotes* Westwood (Coleoptera: Ptinidae) from South Australia

John T Jennings, Andrew D Austin & Richard Bashford First record of the woodwasp family Xiphydriidae from Tasmania with a description of a new species and host record

John T Jennings, Andrew D Austin & Nathan M Schiff The Australian endemic woodwasp genus *Austrocyrta* Riek (Hymenoptera: Xiphydriidae)

Murray J Fletcher & Melinda L Moir *Budginmaya eulae* gen. et sp. nov., a myrmecophilous planthopper (Hemiptera: Fulgoromorpha: Flatidae) from Western Australia

EVOLUTIONARY ENTOMOLOGY

Thomas W Chapman, Leslee Marando, Margot Oorebeek & Sonia Kleindorfer Genetic structure in ixodid ticks from Kangaroo Island and the South Australia mainland

BEHAVIOUR

Hiroki Miyata, Masanori Hirata, Noriko Azuma, Takahiro Murakami & Seigo Higashi Army ant behaviour in the poneromorph hunting ant *Onychomyrmex hedleyi* Emery (Hymenoptera: Formicidae; Amblyoponinae)

PEST MANAGEMENT

Cassie C Jansen, Paul Zborowski, Scott A Ritchie & Andrew F van den Hurk Efficacy of bird-baited traps placed at different heights for collecting ornithophilic mosquitoes in eastern Queensland, Australia

Mohammad S Qureshi, David J Midmore, Shamsa S Syeda & David J Reid Pyriproxyfen controls silverleaf whitefly, *Bemisia tabaci* (Gennadius), biotype B (Homoptera: Aleyrodidae) (SLW) better than buprofezin in bitter melons *Momordica charantia* L. (Cucurbitaceae)

Martin O McLoon & Grant A Herron PCR detection of pirimicarb resistance in Australian field isolates of *Aphis gossypii* Glover (Aphididae: Hemiptera)

Adrián Filiberti, Alejandro Rabossi, Carlos E Argaraña & Luis A Quesada-Allué Evaluation of phloxine B as a photoinsecticide on immature stages of the horn fly, *Haematobia irritans* (L.) (Diptera: Muscidae)

Elissa L Suhr, Stephen W McKechnie & Dennis J O'Dowd Genetic and behavioural evidence for a city-wide supercolony of the invasive Argentine ant *Linepithema humile* (Mayr) (Hymenoptera: Formicidae) in southeastern Australia

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DIARY OF COMING EVENTS

Tuesday October 20th

**"Fuel reduction burning, its affect on the invertebrates and the
consequential impacts on the other animals and forest health"
by Dr. Don Sands**

Tuesday November 17th

Council Meeting

December 8th

Members Meeting

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